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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/709,999	06/11/2004	Michael C. Gaidis	FIS920040017US1	3998

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International Business Machines Corporation
New Orchard Road
Armonk, NY 10504

EXAMINER

LE, DUNG ANH

ART UNIT	PAPER NUMBER
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2818

DATE MAILED: 09/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/709,999	GAIDIS ET AL.	
	Examiner	Art Unit	
	DUNG A. LE	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,8-12,16,17 and 21-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,8-12,16,17 and 21-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Claim Objections

Claim 8 is objected, it depends from canceled claim 5.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2, 10, 12- 15 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. (2005/0020076 A1) in view of Park et al. (2004/0259274 A1).

Lee et al. teach a method of patterning a magnetic tunnel junction (MTJ) stack (especially refer to figs. 2a-2b and related text) comprising:

forming an MTJ stack having a free layer 49 , a pinned layer 45 and a tunnel barrier layer 47 disposed between said free layer and said pinned layer;

masking 53/51 a first area of said MTJ stack while exposing said free layer of said MTJ stack in a second area;

rendering said free layer electrically and magnetically inactive in said second area [0034].

Lee does not teach the step of forming a conductive mask a the conductive line in contacting the hard mask, the hard mask conductively interconnect the MTJ to the conductive line.

Park et al. teach a conductive mask 126/252 and a conductive line 136/236 in contacting the hard mask, the hard mask conductively interconnect the MTJ to the conductive line (especially refer to figs. 5 and 14 and related texts).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to forming a conductive mask a the conductive line in contacting the hard mask, the hard mask conductively interconnect the MTJ to the conductive line in Lee 's method, in order to make contact to the top electrode of magnetic memory cell formed by the patterned MJK [0028].

Regarding claim 2, Lee teaches wherein said stack is formed over one or more interlevel dielectric layers 41 in which one or more respective metal conductor layers 43 are disposed .

Regarding claim 10, Lee teaches wherein said free layer is rendered electrically and magnetically inactive through oxidation [0033].

Regarding claim 12, Lee teaches wherein said free layer is rendered electrically and magnetically inactive by physically 55 altering its composition ([0032] and fig. 2a).

Regarding claim 13, Lee teaches wherein said free layer is rendered electrically and magnetically inactive by adding additional atoms (implanting process 55 in fig. 2a) to said free layer.

Regarding claim 14, Lee teaches wherein the additional atoms are added by ion implantation (implanting process 55 in fig. 2a).

Regarding claim 15, Lee teaches wherein said free layer 19 [0013] includes a layer consisting essentially of nickel-iron (NiFe) .

Claims 1, 3- 4, 3- 12, 17, 21-22 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Ying et al. (2004/0043526 A1) in view of Park et al. (2004/0259274 A1).

Ying et al. teach a method of patterning a magnetic tunnel junction (MTJ) stack (especially refer to figs. 2a- 2f and related text) comprising:

forming an MTJ stack having a free layer 206 , a pinned layer 210 and a tunnel barrier layer 208 disposed between said free layer and said pinned layer;

masking 230/240 a first area of said MTJ stack while exposing said free layer of said MTJ stack in a second area;

rendering said free layer 206 electrically and magnetically inactive in said second area 256 in fig. 2f.

Park et al. teach a conductive mask 126/252 and a conductive line 136/236 in contacting the hard mask, the hard mask conductively interconnect the MTJ to the conductive line (especially refer to figs. 5 and 14 and related texts).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to forming a conductive mask a the conductive line in contacting the hard mask, the hard mask conductively interconnect the MTJ to the conductive line in Ying 's method, in order to make contact to the top electrode of magnetic memory cell formed by the patterned MJK [0028].

Regarding claim 3, Ying teaches wherein said free layer is rendered electrically and magnetically inactive through conversion to an inert compound by chemically altering its composition [0029].

Regarding claim 4, Ying teaches wherein said free layer is chemically altered by plasma treatment [0019] and [0029].

Regarding claim 8, Ying teaches wherein said chemical alteration further includes acceleration of oxygen ions [0029].

Regarding claim 9, Ying teaches wherein said free layer is chemically altered by exposure to a chemical agent including at least one agent selected from the group consisting of fluorine, and carbon [0029].

Regarding claims 12 and 16, Ying teaches wherein said free layer is rendered electrically and magnetically inactive by physically altering its composition and wherein free layer is rendered electrically and magnetically inactive by diffusion of at least one agent out of an adjacent "donor" film into said free layer at least one agent selected from the group consisting of oxygen, nitrogen, fluorine, and carbon [0029].

Regarding claim 17, Part teaches [0024] wherein said hard mask 126/252 includes at least one material selected from the group consisting of titanium nitride (TiN) and tantalum nitride (TaN).

Regarding claim 21, Park teaches wherein a lower surface of said conductive line 136/236 contacts said hard mask (figs.7,14)

Regarding claim 22, Park teaches [0024] wherein said hard mask 126/252 includes titanium nitride (TiN).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 11 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Ying et al. (2004/0043526 A1) in view of Park et al. (2004/0259274 A1) and further in view of the following remark.

Ying in view of Park teaches the claimed invention as applied to claims 1 and 3 including the step of oxidizing the free layer using oxygen based plasma chemistry except for free layer is chemically altered by anodization as cited in current claim.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form free layer is chemically altered by anodization, because this process can be utilized to prevent undesirable or detrimental reactions in the contact region, since it has been held to be within the general skill of a worker in the art to select a known process on the basis of its suitability for the desired application.

Claims 23-27 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee et al. (2005/0020076 A1) in view of Park et al. (2004/0259274 A1) and further in view of the remark.

Lee et al. in view of Park et al. teaches the claimed invention as applied to claim 1 including the free layer includes CoFe, NiFe [0023] except for wherein said free layer includes iron, and said tunnel barrier layer includes magnesium oxide; wherein said step of rendering said free layer electrically and magnetically inactive in said second area forms a moisture barrier for protecting said tunnel barrier layer including magnesium oxide; wherein said free layer includes nickel-cobalt- iron (NiCoFe); wherein said free

layer includes cobalt-iron-boron (CoFeB) and wherein said step of rendering includes oxidizing said CoFeB of said free layer to form a region having glassy oxidized phase as cited in current claims 23-27.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form free layer includes iron, and said tunnel barrier layer includes magnesium oxide; wherein said step of rendering said free layer electrically and magnetically inactive in said second area forms a moisture barrier for protecting said tunnel barrier layer including magnesium oxide; wherein said free layer includes nickel-cobalt- iron (NiCoFe); wherein said free layer includes cobalt-iron-boron (CoFeB) and wherein said step of rendering includes oxidizing said CoFeB of said free layer to form a region having glassy oxidized phase, because the above mentioned material are magnetic elements themselves and they can be used to obtain equivalent effects in place of CoFe, NiFe , since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the particular application.

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is (571) 272-1784. The examiner can normally be reached on Monday-Tuesday and Thursday 6:00am- 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The central fax phone numbers for the organization where this application or proceeding is assigned are (571)272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DUNG A. LE 
Primary Examiner
Art Unit 2818